CLAIMS

What is claimed is:

1. A method of decomposing an image comprising the steps of:

a) decomposing the image into a plurality of stripes;

b) decomposing each stripe into foreground and background image layers, and a mask layer; and

c) interpolating irrelevant pixel values in the foreground and background layers for coder efficiency.

2. The method of claim 1 further comprising the step of:

d) encoding the foreground, background, and mask layers.

3. The method of claim 2 wherein the foreground and background are JPEG encoded, wherein the mask is JBIG encoded.

4. The method of claim 1 wherein step c) further comprises the steps of:

i) determining a layer base color and offsets to a common reduced area of each layer to identify image and mask layer values for all regions except an overlapped common reduced area; and

ii) separating the overlapped common reduced area into foreground and background layers.

5. The method of claim 1 wherein step c) further comprises the steps:

i) classifying each pixel within a selected block of a selected layer as relevant or irrelevant;

ii) generating a coefficient block representing a forward transform of the selected block; and

iii) modifying coefficient values to generate a modified coefficient block subject to a set of pre-determined constraints including a

constraint that the relevant pixels have a same value in an inverse transformation of the modified coefficient block as in the selected block.

6. The method of claim 5 wherein step c)iii) includes the steps of:

a) selecting a coefficient from the coefficient block in a reverse zig-zag order wherein the selected coefficient has a non-zero value; and

b) finding a feasible solution resulting in a zero quantizable selected coefficient subject to the pre-determined constraints.

7. The method of claim 5 wherein the coefficient values are modified subject to a constraint that no zero quantizable coefficient preceding the selected coefficient in the reverse zig-zag order is permitted to become non-zero quantizable.

8. The method of claim 5 wherein values of individual elements of a mask classify pixels in corresponding positions within the selected block as relevant or irrelevant.

9. The method of claim 5 further comprising the step of:

d) providing the modified coefficient block to a block compression process.

10. The method of claim 5 wherein step c) further comprises the step of applying a linear program to identify a feasible solution resulting in a zero-quantizable coefficient subject to the constraints.

11. The method of claim 10 further comprising the step of applying a quadratic program to generate a modified selected block having minimal energy.

12. The method of claim 10 further comprising the step of terminating further modifications to the coefficient block if a ratio of the energy of the modified block to the energy of the initial selected block exceeds a pre-determined threshold.

13. The method of claim 5 wherein the forward transform is one of a discrete cosine, a discrete sine, and a discrete Fourier transform.

14. A method of decomposing an image comprising the steps of:

a) decomposing the image into a plurality of stripes;

b) decomposing each stripe into foreground and background image layers, and a mask layer;

c) identifying an area of intersection of a common reduced foreground area and a common reduced background areas; and

d) interpolating any irrelevant pixel values within the area of intersection for coder efficiency for each layer.

15. The method of claim 14, wherein the area of intersection is selected to have an edge that is 8N pixels from at least one of an edge of the common reduced foreground area and the common reduced background area, wherein N is an integer, wherein N≥0.

16. The method of claim 14, wherein step d) further comprises the steps of:

i) selecting a block of pixels; and

ii) classifying each pixel within the selected block as irrelevant or relevant.

17. The method of claim 16 further comprising the steps of:

iii) calculating an average value of any relevant pixels within the selected block; and

iv) assigning the average value to all irrelevant pixels within the selected block.

18. The method of claim 14 wherein step c) further comprises the steps of:

i) computing a maximum block range for a selected block of the area of intersection;

ii) dividing pixels within the selected block into a plurality of groups; and

iii) assign each selected group to one of the foreground and background planes in accordance with a relative average luminance value of the selected group and another group, if the maximum block range exceeds a pre-determined threshold.

19. The method of claim 18 wherein step c)(iii) further comprises the step of assigning the selected group to the background layer and the other group to the foreground layer if an average luminance of the selected group is greater than an average luminance of the other group, wherein the selected group is assigned to the foreground layer and the other group to the background layer if the average luminance of the selected group is not greater than the average luminance of the other group.

20. The method of claim 14 wherein step c) further comprises the steps of:

i) computing a maximum block range for a selected block of the area of intersection; and

ii) assigning every pixel within the selected block to one of the foreground and the background layers in accordance with whether the average luminance of the selected block is closer to a previous average foreground or previous average background luminance, respectively, if the maximum block range is not greater than a pre-determined threshold.